Northeast Region Inventory and Monitoring Program
Vegetation Map Development Example

North Carolina State University (NCSU)
NPS Field Technical Support Center (FTSC)

Version:2004

Aerial Photography

Specifications were developed for obtaining color infrared, stereo pair, 1:6,000 scale and 1:12000 scale, leaf-off aerial photography with global positioning system (GPS) and inertial mapping unit (IMU) data for the Northeast Region I&M Program Pennsylvania parks and the West Virginia parks respectively (See NCBN Information Plan Appendices for aerial photo specs).

All aerial photos and associated products were delivered to NPS staff for quality checking and product acceptance.

NPS reviewers then submitted the photos to NCSU were they were counted, scanned and placed in the air photo archive maintained at NCSU for the Northeast Region Inventory & Monitoring Program. Associated data and information provided by aerial photo contractors were also stored in the air photo archive.

Creating Orthophoto Mosaics

NCSU staff created one mosaic for each park as follows:

1. The air photos for GETT and EISE were scanned at 600 dpi and then imported into ERDAS Imagine (.img) format. For FRHI, FONE, ALPO, and JOFL. The color corrected, 1200 dpi scanned images provided by the contractor were used.

2. In Imagine, a photo block is created using the airborne gps and imu data and a digital elevation model (DEM).

    For the six Pennsylvania parks, DEMs downloaded from the US Geological Survey seamless data set were used.

    The poor quality of the USGS DEMs for the West Virginia Parks caused problems in the orthophotos generated using them. Therefore, staff generated DEMS for these parks using the photo block and Orthobase software

3. The photo block is manipulated until the photo block can be triangulated with a root mean square error of less than 1. At this point, single frame orthophotos (one for each air photo) are generated within Imagine.

4. The single frame orthophotos are exported to Imagine .lan format and then imported into ER Mapper's native (.ers) format. An ER Mapper algorithm is created which contains the color balancing information and the cutlines created for the final mosaic.

5. ER Mapper is used to generate a band interleaved by line (.bil) image and header file of the final orthophoto mosaic. The .bil image is imported into Imagine .img format. The .img image is then compressed using MRSid software with a 20:1 compression ratio.

Positional Accuracy and Metadata of the Mosaics

Positional accuracy was assessed following guidelines on the USGS-NPS Vegetation Mapping Program website (http://biology.usgs.gov/npsveg/standards.html) which refers to the FGDC standards (http://www.fgdc.gov/standards/status/sub1_3.html). According to these guidelines, data from a minimum of 20 points are needed to assess the horizontal positional accuracy of each mosaic. Following are the specific procedures used to collect and analyze accuracy assessment data and create metadata for each mosaic:

1. Potential positional accuracy points are placed on the final mosaic in ArcMap. At least 20 well-defined ground control points spaced throughout all quadrants of the mosaic are chosen. For most of the mosaics, we selected more than 20 ground control points.

2. The potential ground control points are plotted on hard copy maps of each park (with the mosaic as a background). NCSU staff also plot zoomed in screenshots of each point. These maps and plots are used to locate the ground control points in the field.

3. At each ground control point, field staff recorded the coordinates with a Trimble Pro XR/XRS or GeoXT. Any alterations to the locations of ground control points are noted as well as ground control points that are physically inaccessible.

4. The gps field data are collected with real time gps or are post processed with differential correction using Pathfinder Office software.

5. For each point, field-collected gps coordinates were compared to the coordinates obtained from the mosaic viewed in ArcMap. Both sets of coordinates are entered into a spreadsheet (horizont.xls) in order to calculate what level of horizontal accuracy has been achieved according to National Map Accuracy Standards. This spreadsheet is referenced from the FGDC

(http://www.fgdc.gov/standards/status/sub1_3.html) and was downloaded from the State of Minnesota's website (http://server.admin.state.mn.us/resource.html?Id=1852). Prior to calculating accuracy level, outliers are identified with SAS's JMP program and removed. Following USGS-NPS Vegetation Mapping guidelines, no more than 10 percent of the ground control points for any one mosaic are removed.

6. The final horizontal accuracy of each mosaic is characterized according National Map Accuracy Standards based on the ASPRS Accuracy Standard for Large Scale Maps published in March 1990.

7. Final FGDC compliant metadata is produced in notepad and is parsed using the USGS metadata compiler program (MP) to locate errors and omissions. After any errors or omissions are corrected, MP is then used to generate final .txt, .html, and .xml version of the metadata.

Vegetation Mapping

Vegetation mapping process conducted by NCSU:

1. Open the mosaic in ArcMap and create a new polygon geodatabase in the appropriate projection.

2. Create a polygon topology ruleset to go along with the geodatabase.

3. Start delineating all the different polygons that can be seen in 2d. The minimum mapping unit was .5 hectare but we usually went to .5 acre.

4. Continue until all polygons are delineated and then validate the topology and clean up the dataset.

5. Create the necessary fields in the associated attributes table. (We delineated to formation.)

6. Tag all the polygons with formation level attributes. Other datasets such as existing park data and drg's can be used to supplement this step. Tag any confusing or unknown vegetation types with a notation as such.

7. Imports the geodatabase into a 3d shapefile for use in Imagine's Stereo Analyst and create a Stereo Analyst feature project with the vegetation polygon data.

8. In 3d, visually examine all the existing polygon attributes paying close attention to the polygons marked as unknown or unsure.

9. Import the final attributed shapefile back into a geodatabase and check the topology again.

Thematic Accuracy Assessment

1. Polygon centroid labels were created for each polygon within ArcToolbox with the specification to keep the centroid points within the polygon.

2. Polygon centroid points were selected by a stratified random sample based on section 4.4.2 of the accuracy assessment procedures of the USGS – NPS Vegetation Mapping Program (http://biology.usgs.gov/npsveg/aa/aa.html).

3. These centroids were converted to waypoints for navigational use in Trimble ProXR's supplemented by the use of Garmin gps3+'s.

4. Field crews then navigate to the centroids and collect the field data to complete the USGS – NPS Vegetation Mapping Program Accuracy Assessment Form (our blank forms are dated June 1998).

5. The field data is used to check the accuracy and to update the formation attribute data. A final thematic accuracy is calculated using the final updated vegetation polygons.

8. Final metadata is produced in notepad and is run through MP to make sure it parses correctly. MP is then used to generate final .txt, .html, and .xml version of the metadata.